APPLICATION FOR
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FOR

INTRUDER RESISTANT VENT STRUCTURE

By:

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BACKGROUND OF THE INVENTION

1. Technical Field

The present invention relates to vents for water-storage tanks. More particularly, the invention relates to an intruder resistant vent structure for application onto water storage tanks.

2. Description of Related Art

Storage tanks are often provided with a vent to allow the gas pressure within the tank to equalize to the ambient atmospheric pressure. Particular to water storage tanks for drinking water, it is desirable to prevent any unwanted matter or persons from gaining entry into the storage tank through the vent opening in the storage tank. When water storage tank vents are not properly protected or their protection device fails, insects, birds, other small animals, and trash may gain entry into the drinking water within the storage tank creating a potential health hazard. To prevent this, vent covers are employed over the vent openings.

Common vent covers employed with water storage tanks are known to have an enlarged upper cover having a gradually sloping top to drain water away from entry into the tank. This allows air to enter into and from the storage tank vent opening. A mesh screen is often attached with support elements around the vent cover's opening to prevent the entry of insects into the tank interior. The difficulty with this type of vent cover is that the screens and other components of prior art vent covers are known to fail due to the corrosive environment often found within water storage tanks. Also, animals such as birds or rodents may be able to penetrate screen coverings, especially those that have been weakened due to corrosion. When screen coverings are

compromised, unwanted intruders gain access into the interior of the water storage tank.

Another serious concern with protecting drinking water is from the threat of terrorism. Few prior art vent covers, if any, provide little protection from determined individuals wishing to gain access to the interior of a water storage tank. Therefore, a vent cover that can provide protection from all types of unwanted intruders, including people, is desired. Further, the desired vent cover should be designed to include a multiplicity of deterrents to protect the contents of a storage tank.

SUMMARY OF THE INVENTION

A vent structure according to the present invention deters unauthorized access to a storage tank preferably for water. With water storage tanks, a vent is provided so that atmosphere within the storage tank can communicate with the ambient atmosphere surrounding the storage tank to substantially prevent gas in the void volume of the tank from being compressed or expanded. However, providing a vent to the water storage tank also provides an access point into the tank for unwanted intruders. With the vent structure described herein, the vent opening into a storage tank can be protected.

The vent structure is formed with a bottom plate having a centrally disposed tank opening for attachment to a vent of a storage tank. In a preferred arrangement, a flange may first be affixed to a protruding vent of the storage tank to which the bottom plate may then be attached to the flange. The tank opening allows gaseous flow between an atmosphere in the water storage tank and an atmosphere within the vent structure when connected to the water storage tank. A cover is then affixed above and to the bottom plate to form the vent structure housing. A vent opening formed through the bottom plate allows gaseous flow between the atmosphere of the vent structure and the ambient atmosphere surrounding the water storage tank. A tortuous pathway is disposed within the vent structure between the vent opening and the tank opening to allow gaseous communication between the water storage tank atmosphere and the ambient atmosphere surrounding the storage tank. Further, the tortuous pathway is formed with a plurality of baffles having at least one baffle that extends upward from the bottom plate toward the cover and at least one baffle that depends downward from the cover toward the bottom plate. As additional

protection, a mesh screen covering may be affixed to the openings to the tank and to the vent structure.

To provide further support, the vent structure may include one or more support columns positioned within the vent structure between the vent opening and the tank opening. Each support column extends between the cover and the bottom plate. Preferably, each support column depends from the cover and extends down and through to the bottom plate. At least one of support columns, preferably at least two, has a terminal end that is received and passed through a receptacle in the vent structure. The terminal end then protrudes through the receptacle to an exterior portion of the vent structure whereby a locking mechanism such as a key or combination lock may be affixed to the protruding terminal end. To further protect against unauthorized access, a guard for protecting the locking mechanism extends outward from the bottom plate to form a barrier around the locking mechanism.

BRIEF DESCRIPTION OF THE DRAWINGS

The novel features believed characteristic of the invention are set forth in the appended claims. The invention itself, however, as well as a preferred mode of use, further objectives and advantages thereof, will be best understood by reference to the following detailed description of illustrative embodiments when read in conjunction with the accompanying drawings, wherein:

Figure 1 is an exploded perspective view of an intruder resistant vent structure for use on a water storage tank;

Figure 2 is a side cross sectional view of the vent structure of **Figure 1** shown affixed to a water storage tank;

Figure 3 is a bottom perspective view of the cover of the vent structure of **Figure 1**;

Figure 4 is a top planar view of the base of the vent structure of **Figure 1**; and

Figure 5 is a bottom perspective view of the flange of the vent structure of **Figure 1**.

DETAILED DESCRIPTION

Referring to **Figures 1** and **2**, a vent structure **10** shown in accordance with a preferred embodiment of the present invention is constructed to prevent unauthorized access by intruders, which may include rain, animals, leaves, trash, people, and other foreign matter, into a container to which vent structure **10** has been affixed. Particularly, vent structure **10** is designed to be employed with water storage tanks such as water tank **60**. However, other containers such as chemical storage tanks, transport vessels, and other storage devices requiring venting may employ the vent structure of the present invention. With water storage tanks, venting is provided to allow the open volume or air space within the tank to change without affecting its internal air pressure. Thereby, the flow of water into and out of the tank is not impeded by a contained mass of air within the tank.

Vent structure **10** generally comprises a cover **20**, a bottom plate **30**, and a flange **50**. When assembled, vent structure **10** has a tortuous venting path formed with the use of baffles **26**, **32**, and **34**, which does not substantially impede the flow of gases into or out of a tank. However, this tortuous venting path does deter the entry of undesired matter. Vent structure **10** is cylindrically shaped with one end sealed and the other end partially open for venting and for engaging a storage tank. While shown having a generally cylindrical shape, vent structure **10** may comprise other shapes such as, for example, a box.

The components of vent structure **10** may be comprised of any material that is corrosion resistant and durable such as aluminum, stainless steel, steel, and fiberglass. In a preferred embodiment described herein, cover **20**, bottom plate **30**, and their depending parts comprise,

unless noted otherwise, aircraft aluminum that has a corrosion resistant coating applied thereto. Coated aircraft aluminum is preferred because of its resistance to corrosion, durability, and cost.

Figure 3 shows an additional view of cover **20** having a top **28** and a peripheral edge **29**. As cover **20** is constructed to engage bottom plate **30**, one or more support columns **22** are provided within an interior portion of vent structure **10** to assist in supporting cover **20**. Each support column **22** has an opening **23** located at about its terminal end. Support columns **22** depend from top **28** toward bottom plate **30** wherein columns slots **33** are provided within bottom plate **30** for receiving the terminal ends of support columns **22**. Once assembled, openings **23** pass through columns slots **33** and extend beyond the external underside of bottom plate **30** to provide for the application of one or more locks **38** if desired. For additional security, an optional guard cover **36** is provided on the underside of bottom plate **30** around the periphery of each column slot **33**. Guard cover **36** extends outward from the underside of bottom plate **30** and protects any locking mechanism such as locks **38** that are subsequently attached to opening **23**. While the terminal ends of support columns **22** are shown having openings **23**, an alternative design of the terminal ends may employ flattened ends for engaging the internal top side of bottom plate **30**. In another alternative embodiment not shown, the support columns may stem upward from bottom plate **30** toward top **28**.

In addition to support columns **22** and locks **38**, one or more bolts **24** may be used to secure cover **20** to bottom plate **30**. In application, each bolt **24** is inserted through a cover bolt hole **25** and is received by bottom plate bolt hole **27** located on bottom plate peripheral edge **31**. To retain bolt **24** in position after insertion through holes **25** and **27**, a nut (not shown) is applied to the end of bolt **24**. In addition to or in replacement of bolts **24**, other fasteners, such as rivets,

adhesives, or welding may be employed.

Bottom plate **30** has at least one vent opening **40** for allowing air to pass into or out of vent structure **10**. As shown in further detail in **Figure 4**, a plurality of vent openings **40** are provided in a preferred embodiment. Each opening **40** is disposed between edge **31** and bottom cover outer baffle **32**. Vent opening screen **46** is affixed to the vent opening screen frame **42** to provide a first deterrent to prevent any unwanted foreign matter from entering into vent structure **10** and, subsequently, water tank **60**. Screen **46** is preferably comprised of a fine mesh and is comprised of stainless steel for its strength and corrosion resistance. Frame **42** is also preferably comprised of stainless steel for its strength and corrosion resistance. With the placement of vent openings **40** on the underside of vent structure **10**, the opening into vent structure **10** is less likely to become obstructed with debris such as leaves and trash.

Securing frame **42** and vent opening screen **46** to the top portion of bottom plate **30** are one or more bolts **44**. Therein, each bolt **44** is inserted through an optional washer **45**, then through one of the screen bolt holes **47** located along vent opening frame **42**. The bolt **44** is then subsequently inserted through a corresponding screen bolt hole **48** in bottom plate **30**. Once in position, each bolt **44** is secured into position with the preferable use of a screen bolt nut **49** affixed to the terminal end of each bolt **44**. Furthermore, a plurality of bolts applied about the circumference of frame **42** is preferably used to retain screen **46** in position upon bottom plate **30** to provide increased intruder protection. Bolts **44**, washers **45**, and nuts **49** are preferably comprised of stainless steel for strength and durability. In addition to or in replacement of bolts **44** and associated hardware, other fasteners, such as rivets, adhesives, or welding, may be employed to secure frame **42** and vent opening screen **46** to bottom plate **30**.

To affix the vent structure **10** to a water tank, a flange **50**, as shown in further detail in **Figures 2** and **5**, is mounted onto a tank vent opening such as tank vent **62**. Flange **50** is preferably comprised of cast iron and has an optional screen **56**, which is preferably comprised of stainless steel for strength and durability. Screen **56** is affixed to inner peripheral edge **52** of flange **50** so that screen **56** is in about the same plane as the top of bottom plate **30**. As shown in **Figures 1**, **4**, and **5**, screen **56** provides an additional intruder barrier between vent structure **10** and water tank **60**. Thereby, opening **37** is covered by screen **56** upon attaching bottom plate **30** to flange **50**. For robust attachment of flange **50** to tank vent neck **64**, inner peripheral edge **52** extends beyond planar flange edge **57** toward water tank **60**. Flange **50** is then attached to tank vent neck **64** with welding, adhesives, and/or other fasteners to form a seal. Preferably, an essentially complete seal of edge **52** to tank vent neck **64** is desired to prevent intruders from bypassing vent structure **10** to obtain access to the interior of water tank **60**.

Flange **50** is adapted for mating with the underside of bottom plate **30** at about the bottom plate tank opening **37**, which is disposed centrally in bottom plate **30**. To retain bottom plate **30** to flange **50**, one or more flange bolts **51** are provided for insertion through flange bolt holes **54** and then through a corresponding bottom plate flange bolt hole **58**. Flange bolt holes **54** are formed radially through and along the planar flange edge **57** for alignment with bottom plate flange bolt holes **58**, which are disposed radially about opening **37**. To render the attachment of bottom plate **30** to flange **50** robust, a plurality of flange bolt holes **54** and bottom plate flange bolt holes **58** are provided around the circumference of opening **37** for the placement of flange bolts **51** therethrough. In application, each flange bolt **51** is inserted through a flange bolt washer **53**, flange bolt hole **54**, bottom plate flange bolt hole **58**, and then another flange bolt washer **53**. A

flange bolt nut **55** is applied to the terminal end of each flange bolt **51** to retain it in the desired position. Bolts **51**, washers **53**, and nuts **55** are preferably comprised of stainless steel for strength and durability. In addition to or in replacement of bolts **51** and associated hardware, other fasteners, such as rivets, adhesives, or welding, may be employed to secure bottom plate **30** to flange **50**.

Once assembled and positioned atop water tank **60**, venting may proceed as shown in **Figure 2**. For the occurrence of atmospheric air venting into water tank **60**, a current of air passes through vent opening **40** and vent opening screen **46** up toward cover top **28**. The current of air then passes down toward bottom plate **30** passing over baffle **32**. Thereafter, the current of air passes up between baffles **26** and **34** toward cover top **28**. Finally, the current of air passes down toward and through flange screen **56** for entrance into water tank **60** via water tank vent **62**. For the occurrence of air venting out from water tank **60** into the atmosphere, the venting process described above is reversed.

With the use of a vent cover made in accordance with the present invention such as vent structure **10**, a water tank can be adequately ventilated while restricting access to the interior of the tank. Unlike prior art vent covers for water tanks, the durable and robust venting structure **10** provides sufficient airflow into and out of the tank while providing improved security.

Particularly with the public's concern and need for safe and adequate sources of water, a protective device such as the present invention is of significant importance. This is because vent structures made in accordance with the present invention provide resistance to intruders whether they are naturally occurring or not. For naturally occurring intruders such as rain, animals, leaves, and other foreign matter, the screens, tortuous air path, and other features of the present invention

will prevent their entrance into the interior of the water tank via the protected tank vent.

For intruders such as terrorists, vandals, or other unwanted trespassers, the screens, tortuous air path, locks, robustness and durability of the construction materials, and others features of the present invention, will prevent or at least deter trespassers from introducing unwanted matter into the water tank protected by the vent structure. If, for example, a trespasser wanted to introduce a harmful chemical into the water tank via a hose, a vent opening screen **46** would prevent entry of the hose into vent structure **10**. If the trespasser attempted to spray up into the vent structure through a vent opening screen **46**, the tortuous path would prevent entry into water tank **60**. Because vent structure **10** significantly increases the difficulty of introducing an unwanted substance into water tank **60** by a trespasser, a trespasser may be inclined to apply more extreme measures with the use of, for example, a blow torch, explosives, or other destructive instruments. These however are impractical and are likely to draw the attention of law enforcement or other security forces.

While the invention has been particularly shown and described with reference to a preferred embodiment, it will be understood by those skilled in the art that various changes in form and detail may be made therein without departing from the spirit and scope of the invention.